

Axicabtagene ciloleucel for treating diffuse large B-cell lymphoma and primary mediastinal large B-cell lymphoma after 2 or more systemic therapies (CDF Review of TA559)

For public – AIC and CIC redacted

Technology appraisal committee C [06 September 2022]

Chair: Richard Nicholas

Lead team: Natalie Hallas, Alex Cale, Ugochi Nwulu

Evidence assessment group: Kleijnen Systematic Reviews

Technical team: Lewis Ralph, Vicky Kelly, Ross Dent

Company: Kite, a Gilead Company

NICE

© NICE 2022. All rights reserved. Subject to [Notice of rights](#).

Background on NHL, DLBCL and PMBCL

Fast growing lymphomas affecting approximately 5,500 people

Epidemiology

- NHL comprises blood cancers originating primarily in B-cells; DLBCL most common
- Around 14,200 people diagnosed with NHL each year in the UK
- Each year about 5,500 people are diagnosed with DLBCL; around 40% of NHL
- PMBCL makes up around 5% of all NHL cases

Diagnosis and classification

- NHL diagnosed with biopsy of lymph node to test type, grade, immunohistochemistry and cytogenetics
- DLBCL and PMBCL are high grade (fast growing) lymphomas

Symptoms and prognosis

- Fatigue, night sweats, and painful swelling/lumps in the neck, armpit and groin
- Relapsed/refractory outcomes with standard of care are poor – low levels of response and limited survival
- High burden of disease associated with NHL affects people's quality of life

Axicabtagene ciloleucel (Yescarta, Gilead)

Marketing authorisation	<ul style="list-style-type: none">• Marketing authorisation granted by EMA August 2018: 'for the treatment of adult patients with relapsed or refractory diffuse large B-cell lymphoma and primary mediastinal large B-cell lymphoma after 2 or more lines of systemic therapy'
Mechanism of action	<ul style="list-style-type: none">• CAR T-cell therapy that uses autologous T-cells engineered to express receptors directed against the tumour antigen CD19
Administration	<ul style="list-style-type: none">• T cells harvested and genetically modified to express a CAR• Each single infusion bag contains anti-CD19 CAR-T cells in approximately 68 ml for a target dose of 2×10^6 anti-CD19 CAR-positive viable T cells/kg body weight (range: 1×10^6 – 2×10^6 cells/kg), max 2×10^8 anti-CD19 CAR T cells
Price	<ul style="list-style-type: none">• £280,451 per 68 ml single infusion bag• Approved commercial arrangement (commercial in confidence)

Patient perspectives

Chemotherapy takes significant toll on people with DLBCL and PMBCL

Submissions from Anthony Nolan and Blood Cancer UK

- Multiple prior lines of therapy are attempted with limited or no success before CAR-T is an option for people
- Long courses of harsh chemotherapy treatments take a significant physical and mental toll on people with DLBCL or PMBCL
- DLBCL and PMLBCL have a significant effect on day-to-day life, it takes over people and carers' lives and can feel like a full-time job
- Large mental health impact, people 'downhill, mentally for a prolonged period' despite support from friends and family
- Carers feel isolated, lonely, anxious and helpless when caring for someone with DLBCL or PMLBCL
- "CAR-T was quicker, less harsh on my body..... The most important advantage above all is the success of the treatment. Chemo failed for me and I was told other types would likely have a similar response. However CAR-T worked and continues to work"

I felt so weak after chemotherapy that I really didn't know how my body or my mind was going to cope with everything that was to come

Caring takes over every aspect of your life. It significantly impacted our quality of life, and that of my son

Clinical perspectives

Innovative potentially curative treatment that meets unmet need

Submissions from clinical experts

- Expected to provide clinical benefits for younger patients relapsing after autologous stem cell transplant or who have refractory disease
- CAR-T provides durable remissions (and probable cures) in a minority of patients; for people who receive cells ~40% have this response.
- Some patients will not make it to infusion so proportion likely less in whole third-line population
- CAR-T administration requires specialist centres
- CAR-T therapy is highly innovative and meets the unmet need of providing a potentially curative treatment option
- Real-world CAR-T evidence has largely mirrored clinical trial evidence
- Little further comparative data has been generated in the last 2-3 years

Recap: Summary of original appraisal (TA559) and CDF Review



TA559 Recommendation: Axicabtagene ciloleucel therapy is recommended for use within the CDF as an option for treating relapsed or refractory diffuse large B-cell lymphoma or primary mediastinal large B-cell lymphoma in adults after 2 or more systemic therapies, only if the conditions in the managed access agreement are followed

Although significant uncertainty in cost-effectiveness estimates, committee concluded many assumptions in the company's base case were plausible and might be verified through further data collection.

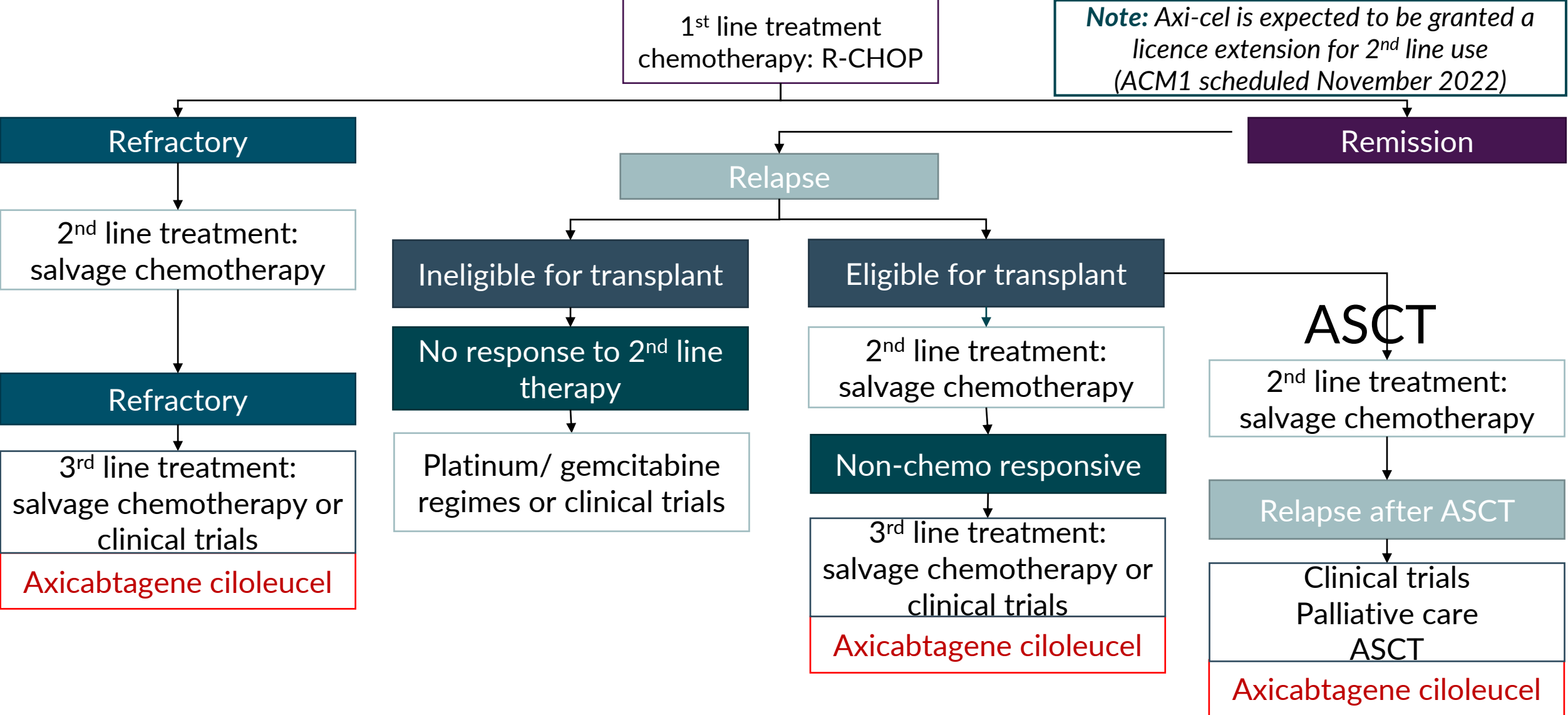
To address uncertainties, further data was to be collected:

- ZUMA-1 clinical trial data
 - OS, PFS and intravenous immunoglobulin G (IVIG) use
- SACT data
 - OS and IVIG use

Recap: Treatment pathway

Axicabtagene ciloleucel could be used in 3 possible positions

Note: Axi-cel is expected to be granted a licence extension for 2nd line use (ACM1 scheduled November 2022)







Recap: Key uncertainties in TA559

Uncertainties in TA559	Committee considerations	
Convergence of PFS and OS curves	<ul style="list-style-type: none"> • Company assumed difference between survival plateaus for axi-cel OS and PFS maintained • ERG provided 2 analyses where OS and PFS converge; no curative post-progression assumptions • No evidence OS and PFS converging in ZUMA-1; data immature 	<ul style="list-style-type: none"> • Acknowledged future ZUMA-1 data-cuts planned - these may provide more certainty • Heard from the company that PFS and OS had not converged in the trial data
Use of IVIG	<ul style="list-style-type: none"> • ZUMA-1 showed small number needed IVIG • NHSE explained B-cell aplasia is a likely consequence of successful axi-cel treatment • IVIG use after axi-cel remained an unknown 	<ul style="list-style-type: none"> • Concerned company underestimated IVIG • Need for IVIG treatment remained unknown, so effect of B-cell aplasia mortality risk uncertain
OS from the infusion of axi-cel	<ul style="list-style-type: none"> • Median OS not reached; data immaturity led to uncertainty in long-term estimates • Company applied mixture cure model with 50% cure fraction • ERG used a hybrid approach 	<ul style="list-style-type: none"> • Company mixture cure model likely to overestimate cure fraction • ERG hybrid approach could be conservative • Concluded OS gain likely to be somewhere in-between

Outstanding issues following technical engagement

PFS only outstanding impactful issue

	Issue	Resolved?	ICER impact
1	Additional comparator data available during the managed access period	Partially	Unknown 
2	Modelling long-term salvage therapy overall survival	Partially	Unknown 
3	Long-term plateau in progression-free survival	No	Large 
4	IVIG use in the model <i>Following TE, SACT data used to inform IVIG in company and ERG base case</i>	Yes	Small 

Clinical effectiveness

Key clinical trials

ZUMA-1 overall survival data matured to 60 months

	ZUMA-1	SCHOLAR-1	SACT data set
Design	Phase 1/2, single-arm, multi-centre, open-label study	Patient level historical control study	Observational study
Population	Adults with aggressive B-cell NHL (DLBCL, PMBCL, and TFL) that was either refractory to treatment or had relapsed ≤ 12 months after ASCT	Adults with relapsed/refractory DLBCL and PMBCL	Adults with relapsed/refractory DLBCL and PMBCL, after 2+ lines of systemic therapy, and TFL after 1+ lines of systemic therapy
Intervention	Axicabtagene ciloleucel	Salvage chemotherapy, rituximab maintenance, observation post-ASCT	Axicabtagene ciloleucel
Comparator(s)	Not applicable	Not applicable	Not applicable
Duration	60 months minimum follow-up	Approx. 4 years median follow-up	Unclear
Outcomes	<ul style="list-style-type: none"> • OS • PFS • IVIG usage 	<ul style="list-style-type: none"> • OS • Objective response rate 	<ul style="list-style-type: none"> • OS • IVIG usage
Locations	24 centres (23 USA, 1 Israel)	USA, Canada, France	UK
Used in model?	Yes	Yes, comparator arm	No

Abbreviations: Approx., approximately; ASCT, allogenic stem cell transplant; DLBCL, diffuse large B-cell lymphoma; IVIG, intravenous immunoglobulin; NHL, non-Hodgkin lymphoma; OS, overall survival; PFS, progression-free survival; PMBCL, primary mediastinal large B-cell lymphoma; SACT, systemic anti-cancer therapy; TFL, transformed follicular lymphoma; UK, United Kingdom; USA, United States of America.

ZUMA-1 efficacy data update (1)

OS updated to 60 months, PFS to 24 months

Update from TA559

- TA559 used August 2017 data cut (median follow-up 15.4 months, median OS not reached, median PFS 5.8 months)
- Key uncertainties were OS estimates for axi-cel and convergence of OS and PFS
 - OS and PFS were to be updated during the data collection period with the latest ZUMA-1 data to address uncertainty
- Latest ZUMA-1 data cut (11 Aug 2021) includes 60 months minimum follow-up
- PFS only updated up to a follow-up of 24 months, due to protocol mandate

Key 60-month OS results

- Median follow-up: ■■■ months; Max: ■■■ months
- Median survival: ■■■ months
- ■■■ patients (■■■%) had died at database lock
- 60-month survival rate in people with complete response: Phase I, ■■■%; Phase II, ■■■%

Key 24-month PFS results

- Median follow-up: ■■■ months
- Median PFS: ■■■ months
- Observed plateau at ■ months ~40%

ZUMA-1 efficacy data update (2)

OS and PFS plateau before heavy censoring

ZUMA-1 OS Kaplan–Meier (60 months; Aug 21 DBL)

ZUMA-1 PFS Kaplan–Meier (24 months; Aug 21 DBL)



OS plateau at ~■% – heavy censoring at ■ months



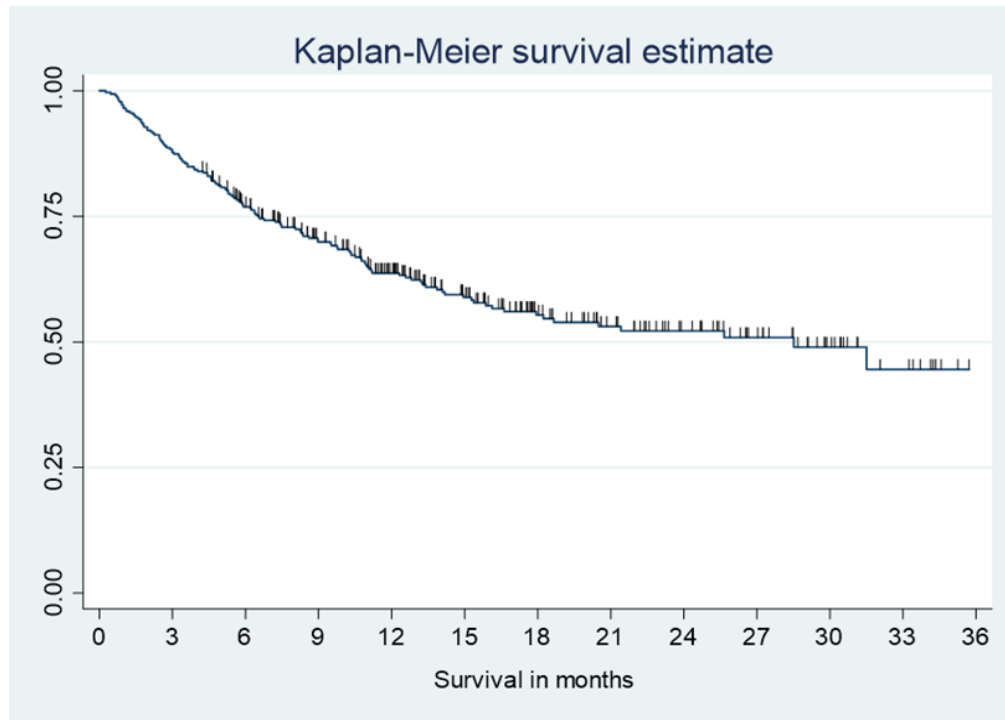
PFS plateau at ~■% – heavy censoring at ■ months

Systemic anti-cancer therapy efficacy

SACT overall survival appears consistent with ZUMA-1

- Real-world axi-cel effectiveness data in the CDF population (between Dec 2018 and Oct 2021)
- Median age receiving axi-cel infusion, 59.5 years (ZUMA-1, 58 years)
- Median OS, 28.5 months (ZUMA-1, 23.5 months)
- 37% of people had missing ECOG performance status (0 = 24%; 1 = 35%; 2 = 4%)

SACT OS Kaplan-Meier (Oct 21)



SACT versus ZUMA-1 OS

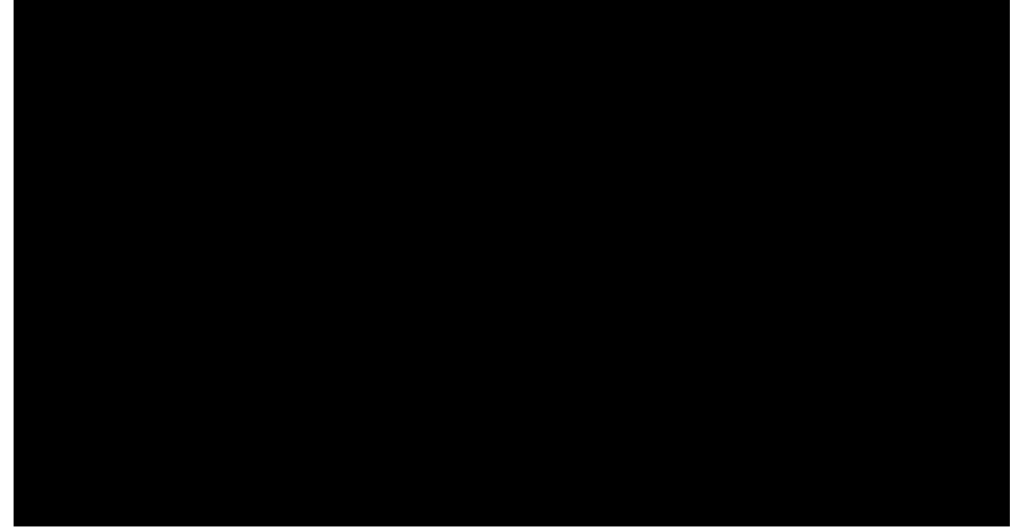
Month	ZUMA-1	SACT
6	██████████	77%
12	██████████	64%
18	██████████	55%
24	██████████	52%
30	██████████	49%
36	██████████	45%

Key: SACT, Systemic Anti-Cancer Therapy.
 Notes: Comparison made with ZUMA-1 Phase I and II mITT (N = 108, 11 Aug 21 DBL)

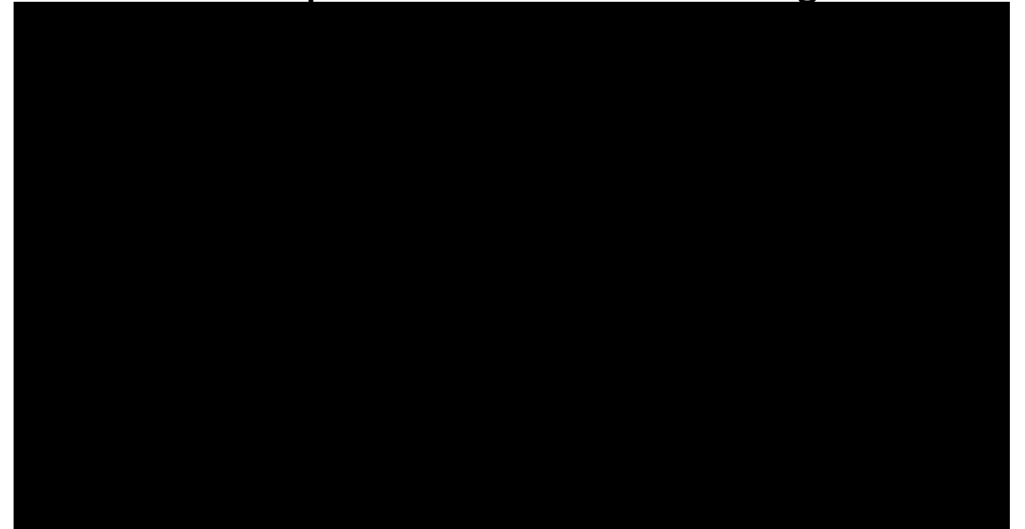
Salvage chemotherapy – SCHOLAR-1

- Company modelling approach unchanged since TA559
- Company adjusted SCHOLAR-1 to ensure comparability with the ZUMA-1 population
 - Unknown and ECOG-PS 2 to 4 excluded, consistent with ERG-preferred approach
 - Primary refractory patients excluded, consistent with the marketing authorisation
 - Resulting OS curve was adjusted to reflect outcomes for a population in which 10% of patients have subsequent SCT, consistent with TA567 (tisagenlecleucel for DLBCL)
- Committee preferred generalised gamma to extrapolate OS for salvage chemotherapy in TA559

KM and selected parametric curves (generalised gamma) for the non-SCT and SCT populations



OS and PFS extrapolations for axi-cel and salvage chemotherapy



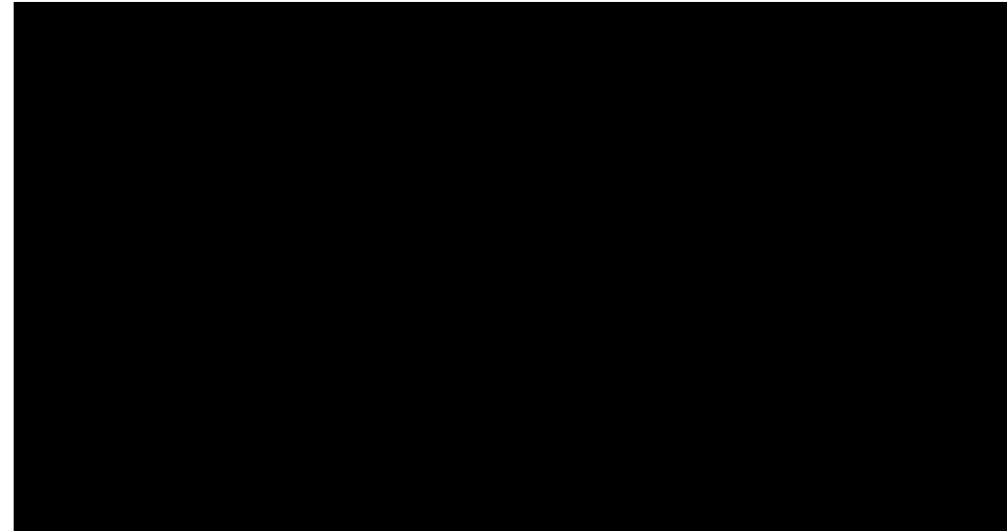
Key issues 1&2: Comparator data - modelling long term OS (1)

No new data, comparator still informed by SCHOLAR-1

SCHOLAR-1 extrapolation and Radford et al. 2019

Background

- Results from SCHOLAR-1 used to model long-term OS for the salvage chemotherapy arm in TA559
- CDF Terms of Engagement states that in addition to using SCHOLAR-1 data, the submission should use *“any additional data that has become available during the period of managed access to inform the comparator arm”*



Company

- Conducted a targeted literature review of chemotherapy in 3L DLBCL, only one study based in the UK (Radford et al. 2019)
- Company extrapolation using SCHOLAR-1 data broadly consistent with the 3L data from Radford et al. 2019
- Argue SCHOLAR-1 still most appropriate source for long-term OS outcomes for the comparator

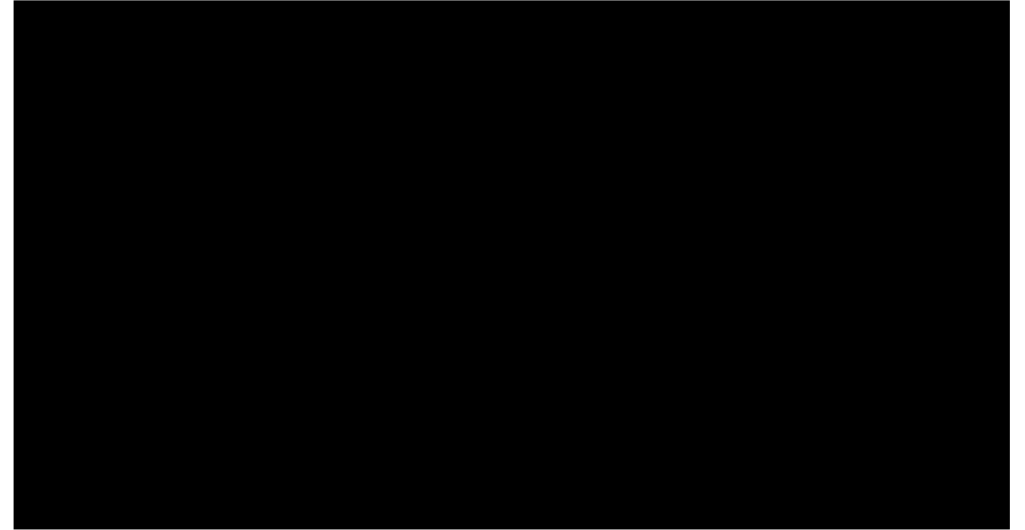
Key issues 1&2: Comparator data - modelling long term OS (2)

No new data, comparator still informed by SCHOLAR-1

ERG and NICE technical team comments

- Indirect comparison of axi-cel and salvage chemotherapy is made without any measures of uncertainty; interpretation difficult
- The company targeted literature review found 3 sources, with only 1 in the UK; Search only used 1 database, so important sources may have been missed
- Company excluded alternative comparator data as weren't conducted in the UK, but SCHOLAR-1 and ZUMA-1 not UK
- Company adjusted SCHOLAR-1 dataset to be more reflective of ZUMA-1 and UK practice; substantially reducing sample size from 562 to 133
 - Other studies not included by company: Radford (UK), N = 89; Fujii (Japan), N = 189; Nakaya (Japan), N = 131
- Alternative OS scenarios explored by ERG indicate that results sensitive to changes in comparator OS extrapolation

SCHOLAR-1 extrapolation and Radford et al. 2019



Is SCHOLAR-1 the most appropriate data source for the comparator?

Cost effectiveness

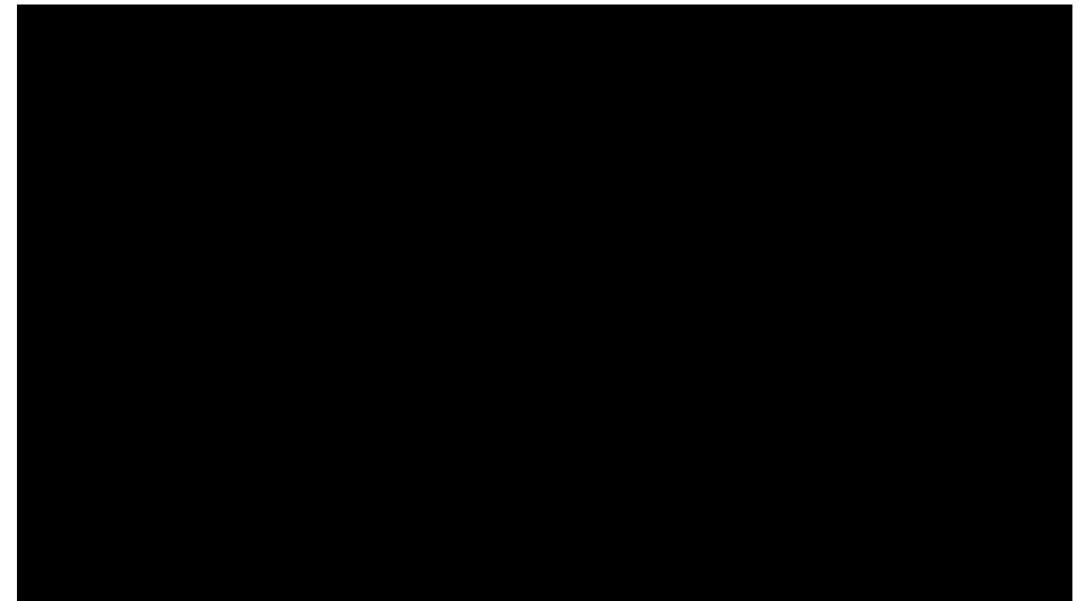
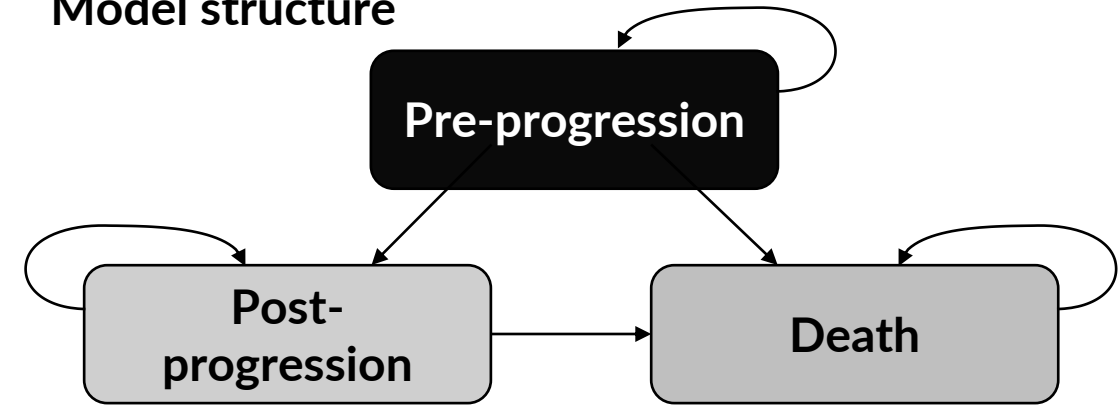
Company's cost-effectiveness model overview

3-state partitioned survival model – OS and PFS modelled independently

Key model parameters

Parameter	Assumption and data source
Time horizon; Cycle length	44 years; 1 month
Discount rate	3.5%
Overall survival	Axi-cel: log-logistic MCM BSC: standard generalized gamma, ZUMA-1 60 month data
Progression-free survival	Axi-cel: standard Gompertz BSC: OS/PFS ratio, ZUMA-1 24 month data
Utility	Health state utility, ZUMA-1 safety population
IVIg	SACT: 16% of people every 4 weeks for 6.5 months

Model structure



Axi-cel overall survival predictions

Updated OS with ZUMA-1 60-month data, mixture cure models used

Background

- Standard models implausible; MCMs used in TA559 base case
- NICE DSU TSD 21 released after TA559 supports flexible models
- ToE: Use latest ZUMA-1 data to inform OS; SACT to validate

Company

- MCMs used to combine:
 - Estimated long-term survivor (“cure”) fraction
 - Age-/gender-matched mortality for long-term survivors
 - Parametric model for non-long-term survivors
- All MCMs provided a good fit to the data, plausible cure fractions and long-term estimates
- Log-logistic selected in base case (best statistical fit)

ERG comments

- Updated data cut reduced uncertainty of cure fraction and was lower than the 50% fraction in TA559
- Agreed with company approach; highlighted all MCM and spline curves higher than KM – may overestimate survival

ZUMA-1 MCM OS extrapolations

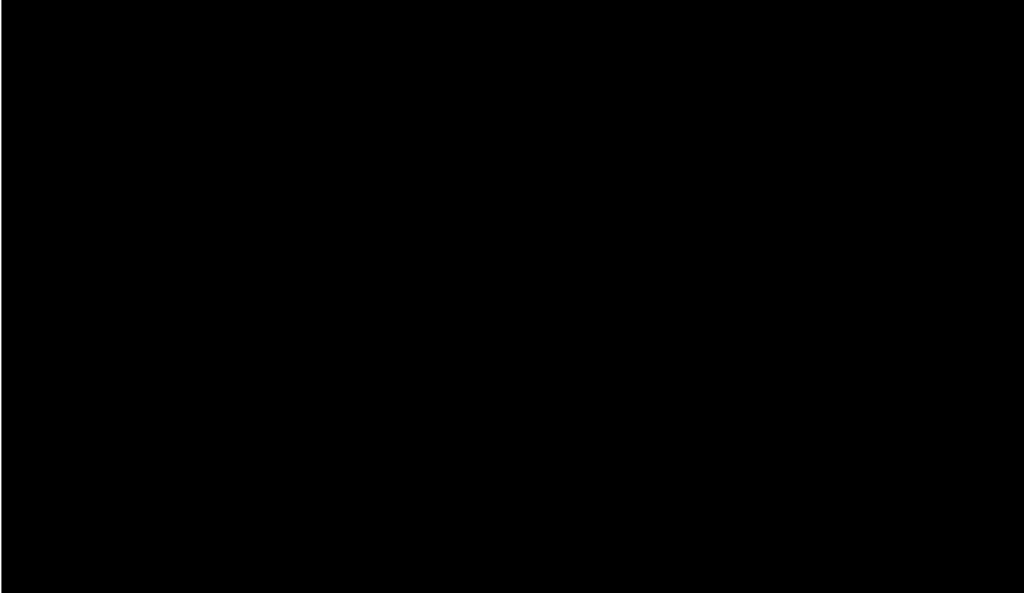


Table x ZUMA-1 OS cure fractions

Model	Implied cure fraction
Exponential	
Weibull	
Gompertz	
Log-logistic [selected]	
Log-normal	
Generalised gamma	

Key issue 3: Axi-cel progression-free survival (1)

PFS only updated to 24 months, outcomes still uncertain



Background

- TA559: standard Gompertz model, 12 months of data used before heavy censoring
- ToE: PFS to be updated with latest data to address uncertainty and convergence of PFS and OS curves

Company

- Update: standard Gompertz, 24 months of data – to maintain consistency with TA559
- No protocol mandate to collect progression data after 24 months, any ZUMA-1 data after not consistent
- Argue that, as model uses mature “stable” survival data, further PFS will not likely change cost effectiveness
- State long-term ZUMA-1 data show few progression events between 2 and 4+ years; no evidence provided
- Following TE, extra scenario considers an SMR of 1.09 applied to PFS after 24 months, minimal ICER effect

ERG and NICE technical team comments

- Requested PFS data beyond 24 months (e.g. 60-month data) to be provided; company did not provide
- Substantial censoring at Month 23/24 shows any plateau in PFS still uncertain
- Month 24-48: █ OS events (with no censoring), possibly feature in PFS curve and would drop curve
- MCMs appropriate, allowing consistent modelling between OS and PFS
- Company SMR scenario still has assumption of long-term plateau in ZUMA-1 data at 2 years; other methods may not have minimal effect
- ERG next best standard model increases ICER by ~£17,000; ERG also ran MCM and spline scenarios

Key Issue: Axi-cel progression-free survival (2)

PFS extrapolations remain uncertain

ZUMA-1 PFS extrapolations: Standard parametric



ZUMA-1 PFS extrapolations: A, mixture cure; B, splines



Company use KM to 35m to validate and inform Gompertz curve selection; despite heavy censoring at 23/24 months, <6% patients “at risk” 24-35m Potentially misleading after month 24 – ‘artificial plateau’ created until Month 35 (no events but patients not followed up)

Has missing PFS been appropriately accounted for?

Which is the most appropriate extrapolation for PFS?

Summary of company and ERG scenarios

Consistent company and ERG base case following TE, different scenarios

Assumptions in company and ERG base case

	Base case assumptions	Company scenarios	ERG scenarios
OS	Axi-cel: Log-logistic MCM BSC: Generalised gamma	Axi-cel: 2-knots normal spline	BSC: Gompertz
			BSC: Log-logistic
			BSC: Log-normal
PFS	Axi-cel: Gompertz BSC: OS/PFS ratio applied	SMR 1.09 applied to hazard of death at 24 months	Generalised gamma
			2-knots normal spline
IVIG	16% of people every 4 weeks and treatment duration 6.5 months	16% of people every 8 weeks for 6.5 months	Updated SACT analysis 19% of people every 4 weeks for 9.5 months

Results containing confidential prices for other treatments will be presented in Part 2

Base case results – includes axi-cel PAS

ERG and company base case aligns

Deterministic incremental base case results – following technical engagement

Technology	Total costs (£)	Total QALYs	Incremental costs (£)	Incremental QALYs	ICER (£/QALY)
BSC	████████	████			
Axi-cel	████████	████	████████	████	£50,480

Probabilistic incremental base case results [run by ERG*]

Technology	Total costs (£)	Total QALYs	Incremental costs (£)	Incremental QALYs	ICER (£/QALY)
BSC	████████	████			
Axi-cel	████████	████	████████	████	£51,203

*The ERG identified (and corrected) an error in the company's model regarding the probabilistic sensitivity analysis (PSA)

Results containing confidential prices for other treatments will be presented in Part 2

ERG deterministic scenario analysis – includes axi-cel PAS

ERG scenario analyses (deterministic)

	Scenario (applied to company base case)	ICER (£) versus BSC
	Base case	£50,480
OS	Gompertz used for BSC	£55,787
	Log-logistic used for BSC	£46,048
	Log-normal used for BSC	£46,977
PFS	Generalised gamma for axi-cel	£67,765
	Lognormal mixture cure model for axi-cel	£51,096
	Spline model: two knots normal for axi-cel	£55,257
IVIG	Updated SACT analysis (19% every 4 weeks for 9.5 months)	£50,815

Results containing confidential prices for other treatments will be presented in Part 2

Other considerations

Axi-cel innovative and meets end of life criteria

Equality considerations

Anthony Nolan

- Tertiary oncology centres often difficult and expensive for patients to access on a regular basis

NHSE

- Noted in TA559 the need for a phased implementation period due to novelty of CAR-T treatments

Innovation

- Single infusion and single treatment rather than recurrent cycles of traditional chemotherapy
- CAR-T treatments represented a step-change in management of people with R/R disease

End of Life Criteria

- Met both short life expectancy and extension to life criteria in TA559

Thank you.